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05. Chemistry

Northeastern State University

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Abstracts from the 2015 Oklahoma Research Day

Held at Northeastern State University

01. Mathematics and Science

05. Chemistry

05.05.01 Insight into the Inhibition of metallo-beta-lactamase from *Bacillus anthracis*

Joshua, Watie *Northeastern State University*

Sung-Kun, Kim *Northeastern State University*

Whenever bacteria develop a resistance to antibiotics, it is important to find a way to bypass or negate the bacteria's resistance. In this research, the bacteria *Bacillus anthracis*, causing anthrax, has developed a metallo-beta-lactamase (Bla2), which destroys the beta-lactam antibiotics such as penicillins, cephalosporins, monobactams, carbapenems. In order to resolve this issue, two newly synthesized compounds, compound 4 and compound 7, have been used to see if they can inhibit Bla2. Our previous results showed that the compound 7 has its ability to inhibit Bla2 effectively. To understand the interaction between the compound and Bla2, molecular docking programs were used - AutoDock 4 and AutoDock Vina. The molecular dockings were examined and compared to determine which of the results would be best to explain how the compound binds to Bla2. From these results, we confirmed that compound 7 binds to the active site of the enzyme. This observation is consistent with the experimental results.

05.05.02 A Computational Study of Electron Donating and Electron Withdrawing Substituents on Phenazine and Dibenzo-[b,i]Phenazine

Daniel, McInnes *East Central University*

Kayle, DeNike *East Central University*

N-substituted polycyclic aromatic hydrocarbons are proposed for use as organic solid state transistors or switches. Simple molecules of this sort include phenazine and dibenzo[b,i]phenazine. This study examines the band gaps of these molecules after substitution of electron withdrawing and electron donating substituents. The most effective substituent in lowering the band gap for phenazine was the electron donating isopropyl group. This group produced a band gap of 0.09087. For dibenzo[b,i]phenazine, the electron withdrawing substituent -OCF₃ was most efficient, producing a band gap of 0.07080.

05.05.03 SIMPLE SOL-GEL SYNTHESIS OF ANTIMONY DOPED TIN OXIDE THIN FILMS

John,Dale *East Central University*

A sol-gel method was established and used to prepare thin films of antimony doped tin oxide (ATO). The ATO was prepared by dissolving SbCl₃ and Sn separately in aqua regia. The two solutions were combined and the PH was lowered. Ethylene glycol was added and the solution was stirred for 12 hours then washed with ethanol till Cl free. The precipitate was suspended in ethanol. Films were made by depositing the ATO sol-gel to microscope slides and annealing the slides in air at 500°C for 3 hours. Typical film thickness is approximately 1µm. The purpose of preparing these films was to examine the effects of thermal and electro-thermal annealing followed by hydrogenation on the resistance of ATO. Thus far thermal annealing of slides results in a sheet resistance 132KΩ. The results indicate that this sol-gel based method of producing ATO films can be used in producing optoelectronic devices.

05.05.04 Characterization of DMID, an Isoflavonoid Pathway Enzyme, via Interactions With Vestitone Reductase

Abe,Blackburn *Southeastern Oklahoma State University*

James,Sharp *Southeastern Oklahoma State University*

Nancy,Paiva *Southeastern Oklahoma State University*

Tyler,Shannon *Southeastern Oklahoma State University*

Isoflavonoids benefit human health by acting as antioxidants or mild phytoestrogens reducing heart disease, osteoporosis, and cancer rates. All enzymes leading to pterocarpanes (a class of isoflavonoids) have been cloned except for DMID [7,2'-dihydroxy-4'-methoxy-isoflavanol (DMI) dehydratase]. DMID was discovered as the final enzyme leading to pterocarpanes, and was demonstrated to exhibit weak protein-protein interactions with the preceding enzyme VR (vestitone reductase). Our goal is to use protein-protein interactions and new protein techniques to isolate enough DMID or partial sequence to allow its eventual cloning and characterization. Alfalfa seedlings were grown and treated according to published methods. The levels of VR in protein extracts were assessed using SDS-PAGE and Western blotting using anti-VR antiserum. Crude protein extracts were concentrated using centrifugal filtration, and an attempt was made to purify or enrich VR and DMID using co-immunoprecipitation. We are improving upon a previous method by using Protein G-magnetic Dynabeads in place of Protein A-red agarose. We have established methods for producing protein extracts containing high levels of VR, and these should also be a good source of DMID. We are continuing our DMID purification efforts by finding an appropriate ratio of beads, antibody, and protein extract before scaling up.

05.05.05 Effects of Laser Immunotherapy on Hormone Secretion in the Pancreas Following Treatment for Pancreatic Cancer

Erica, Halterman *University of Central Oklahoma*

Laser immunotherapy has been shown to help treat and destroy tumors and metastasis in both breast and skin cancer and is now being applied to pancreatic cancer as well; however, it has not been tested as treatment of pancreatic cancer and the effects it will have are unknown. Hormones are produced within the pancreas and secreted by the endocrine gland that are vital to cell productivity and life. I am proposing a study to investigate and observe the effects that laser immunotherapy has on the hormone levels produced in the pancreas, specifically insulin, and whether or not treatment will decrease the production of these hormones both during and after treatment. By monitoring the productivity of the pancreas during and after treatment, it can be determined whether the treatment is able to cure the cancer while leaving the pancreas to continue its role in the body unharmed.

05.05.06 Use of *Oscillatoria limnetica* lipids as salinity proxies

Phillip, Murray *Northeastern State University*

Salinity of water bodies is related to the rates of precipitation and evaporation. Salinity proxies have been used to study precipitation patterns and climate variability. Currently D/H and O18 proxies are used for paleoclimate reconstruction and climate variability prediction. However due to systemic errors associated with these proxies, there is a necessity for development of new proxies. In this project, we propose use changes to the lipid composition of *Oscillatoria limnetica* at different salt concentrations as a salinity proxy for paleoclimate reconstructions in regions where precipitation patterns constitute a major feature of climate variability. *O. limnetica* is a halophilic cyanobacterium that can grow at saturated salt concentrations, alkaline pH, and 47°C. Our interest in *O. limnetica* is based on the following: (i) *O. limnetica* is among the most halophilic organisms known. (ii) Despite the extreme halophilicity, *O. limnetica* grows at broad range of salt concentrations. (iii) Chemical composition of *O. limnetica* lipids have been identified and changes in this composition in response to salt concentration were analyzed using GC/MS.

05.05.07 Solvent Diffusion from Polymer Solutions with Lyotropic Liquid Crystalline Capability

Brittney, Rogers *Northeastern State University*

Carl, Aronson *Northeastern State University*

Thin films of poly(n-alkyl isocyanate) solutions were juxtaposed against air in a diffusion couple geometry at room temperature. The solvent was allowed to diffuse away and evaporate from the solution in a controlled manner. The diffusion couple geometry produced a uniform film for optical assessment of liquid crystalline potential between crossed polarizers. After an induction period, a stable microstructure developed in which the interior of the sample remained isotropic followed by a liquid crystalline band, with characteristic disclination defects and texture, followed by a crystalline band nearest to the external surface. The width of the total characteristic birefringent band was measured over time and provided information concerning the dynamics and trajectory of solvent transport and evaporation from the cover slip edge. The apparent solvent diffusion coefficient for each system was measured at room temperature as a function of initial polymer concentration. Consequences for concentrated biological macromolecular systems possessing lyotropic capability are discussed with respect to the concentration dependence of solvent diffusion observed herein.

05.05.08 Consequences of Steric Mismatch on Tg Composition Dependence

Carl, Aronson *Northeastern State University*

William, Brewer *Northeastern State University*

An investigation of phenolic functional group accessibility in hyperbranched poly(4-hydroxystyrene) (PHS-B) is presented. The phase behavior and extent of hydrogen bonding in blends of either PHS-B or linear PHS with hydroxypropylcellulose (HPC), a complimentary Lewis basic polymer, were calculated from glass transition temperature (T_g) enhancements measured using differential scanning calorimetry (DSC) techniques. The effects of local steric screening and overall steric mismatch as well as the thermodynamic competition between inter-molecular and intra-molecular hydrogen bonding are discussed with respect to the observed miscibility and compositional dependence of blend T_g . An extension to literature equations applicable to conventional, symmetric polymer blend T_g composition dependence is presented in order to model asymmetric T_g composition dependence. Modeling utilized an extrapolated blend composition wherein linear and parabolic behaviors coalesced. Furthermore, the effect of varying the Lewis base linear polymer molecular weight on the hydrogen bonded PHS-B fraction is discussed with respect to the free energy of mixing polymers from Flory-Huggins theory. PHS-B/HPC blend data helped begin to establish a new molecular architecture-functional group accessibility property relationship for use with the design of functionalized hyperbranched synthetic macromolecular targets.

05.05.09 An Amperometric Biosensor for Glucose Determination Using ortho-Nitroaniline and Carbon nanotube Modified Microelectrode

Jude, Abia *Northeastern State University*

Taimoor, Khan *Northeastern State University*

In this study, an amperometric glucose micro-biosensor with immobilization of glucose oxidase on electrochemically polymerized ortho-nitroaniline/multi-walled carbon nanotubes (PoAN/CNT) films has been accomplished via the entrapment technique. Electropolymerization of ortho-nitroaniline on the surface of the 10micron Pt electrode was carried out at constant potential (0.75 V, vs. Ag/AgCl) using an electrochemical cell containing ortho-nitroaniline, glucose oxidase, and multi-walled CNT. The working conditions for preparing the film was optimized and effects of temperature, pH and operational stability were investigated. Quantification of glucose was carried out by the oxidation of enzymatically produced H_2O_2 at 0.4 V vs. Ag/AgCl. The micro-biosensor showed a fast response time of 2.0s, a glucose calibration detection limit of $5.8 \times 10^{-8}M$, 98% of initial activity was retained after 30 days (when stored in 0.1 M phosphate buffer solution at 4 °C), and no significant interference from L-ascorbic acid, uric acid, and acetaminophen.

05.05.10 Low cost synthesis and analysis of graphene and the effect of adsorption of organic compounds with structure.

Barry,Lavine *Oklahoma State University*

Evan,McIntyre *University of Central Oklahoma*

John,Bowen *University of Central Oklahoma*

Kelsie,Magiera *University of Central Oklahoma*

Keith,Jackson *University of Central Oklahoma*

Tye,Chapman *University of Central Oklahoma*

A low-cost synthesis of graphene, derived from the Hummers and Offeman method was developed. A commercial grade graphite lubricant was exfoliated with concentrated acid, oxidized by permanganate to produce graphene oxide (GO) This was then reduced using hydrazine hydrate to produce graphene. Products were analyzed using Raman Spectroscopy and SEM. Both species were used to observe the effect of structure of various organic species on absorption in water. The adsorption was analyzed by difference using solid phase micro extraction (SPME) and gas chromatography mass spectrometry.

05.05.11 Analysis of leaching of dibutyl phthalate from a commercial faucet hose into water using solid phase microextraction (SPME) and Gas Chromatography Mass Spectroscopy (GC MS)

Dalton,Lewis *Edmond North HS*

Erin,Brooks *H.S. Homeschool*

F.,Albahadily *University of Central Oklahoma*

Juliette,Chisam *Edmond North HS*

John,Bowen *University of Central Oklahoma*

Justin,Westhover *H.S. Homeschool*

Luis,Figueora *University of Central Oklahoma*

Shawna,Ellis *University of Central Oklahoma*

Thomas,Briscoe *University of Central Oklahoma*

Various Phthalate Esters are used as plasticizers in commercial plastics and are known to leach into drinking water. Some are also implicated as endocrine disruptors. For this study, a common flexible plastic faucet hose was purchased from a hardware store, and analyzed using SPME-GCMS using an internal standard. Timed samples of deionized water were exposed to the hose, and quantitated for dibutyl phthalate concentration. Several internal standards were synthesized and used for this study.

05.05.12 Playing to Our Strengths: Helping Students Get the Most of a PUI Education in Chemistry

Cheryl, Frech *University of Central Oklahoma*

Luis, Montes *University of Central Oklahoma*

The University of Central Oklahoma (UCO) Chemistry Department has 200 chemistry majors with a range of post-graduation goals. A small percentage of these students end up in graduate programs in the chemical sciences each year. We have identified several factors that correlate with students' eventual success in a graduate program. These include: participation in undergraduate research, either in the department or in a summer REU, active membership in the department Chemistry Club, attendance at a regional or national chemistry meeting, and a successful mentoring relationship with one or more department faculty. We will discuss current preparation of our majors and share some advice from successful students.

05.05.13 Development of a microfluidic immunological assay for the detection and identification of Bluetongue virus and EHDV induced antibodies in serum.

Barry, Lavine *Oklahoma State University*

F., Albahadily *University of Central Oklahoma*

Jane, Jarshaw *University of Central Oklahoma*

John, Bowen *University of Central Oklahoma*

Mary, Tappert *University of Central Oklahoma*

Robert, Brennan *University of Central Oklahoma*

William, Wilson *USDA*

This study describes the development and testing of a microfluidic immunological assay that combines lateral flow assay and microfluidic paper-based analytical device designs for the purpose of detecting and identifying antibodies in serum from sheep exposed to Bluetongue Virus and/or EHDV. Initial design research was done using BSA and anti-BSA to mimic the actual target antibody/antigens. The final assay design will use BTV or EHDV proteins as antigen and animal serum as primary antibody, with antigen-antibody binding detected by a fluorophore- or gold nanoparticle-labeled secondary antibody. We here describe the stepwise optimization of antigen binding, antibody flow, and complex detection in a microfluidic system.

05.05.14 Electrochemical Properties of Graphene Absorption

F.,Albahadily *University of Central Oklahoma*

John,Bowen *University of Central Oklahoma*

Yushi,Zang *University of Central Oklahoma*

Reduced graphene oxide was prepared and formed into a specially constructed form with electrodes on either end. Conductance and current were observed as phthalate esters were adsorbed onto the surface.

05.05.15 SYNTHESIS OF ENAMINONES USING COPPER AS A CATALYST

Arpan,Pal *University of Tulsa*

Erika,Lopez *University of Tulsa*

Syed,Hussaini *University of Tulsa*

Enaminones are synthetic intermediates in organic synthesis that contain the $N-C=C-C=O$ functional group. These compounds are useful in the development of pharmaceuticals. Although the biological activity of enaminones is not well-documented, enaminones have currently come under investigation because of their therapeutic potential. Recently, our research group has found a ruthenium catalyzed method for the synthesis of enaminones. This project uses a copper catalyzed method for the synthesis of enaminones. Copper (II) bromide was investigated for the coupling of a diverse group of thioamides and diazo compounds. Temperature and time were screened and the catalyst was found to give 100% conversion of several thioamides into the corresponding enaminones at 90 °C using dichloroethane as a solvent. Copper (II) bromide shows a broad substrate scope in the synthesis of enaminones. By using a copper catalyzed method, the reaction has become more economical.

05.05.16 Determining concentrations of Copper, Iron, and Zinc by standard addition using Flame Atomic Absorption Spectrophotometry

daniel,montalvo *University of Central Oklahoma*

Amounts of zinc, copper and iron in randomly collected hair samples were investigated. The analysis was based on data collected using the standard addition method in conjunction with Flame Atomic Absorption Spectroscopy. Hair samples were digested with nitric acid appeared to show significantly higher concentrations of zinc and iron (n 30% higher) compared to hair samples digested in nitric acid and 30% hydrogen peroxide. Amount of copper in the hair samples were below limit of detection for the instrument used and hence was not determined.

05.05.17 Cu-Bicyclen as a DNA Cleavage Component for use in Artificial Nucleases

Lori,Gwyn *Southwestern Oklahoma State University*

Sequojah,O'Neal-Johnson *Southwestern Oklahoma State University*

Tim,Hubin *Southwestern Oklahoma State University*

Antibiotic resistant bacteria such as Methicillin (MRSA) and Vancomycin (VRSA) resistant Staph. aureus have proven to be lethal. A possible alternative to developing new antibiotics is to synthesize artificial nucleases to attack the genes of antibiotic resistant bacteria. Nucleases are enzymes that hydrolyze (cleave) phosphodiester bonds in the backbone of nucleic acids. Binding specificity of naturally occurring nucleases ranges from non-specific to very specific. For this project, an engineering approach was used to make modular artificial nucleases with differing DNA specificities and DNA cleavage rates. In general, nucleases have a DNA cleaving and DNA binding domain. Metal-chelates are compounds that have been shown to exhibit some nonspecific DNA cleavage activity. In this study, the DNA cleavage activity of $[\text{Cu}(\text{C}_{12}\text{H}_{26}\text{N}_4)(\text{H}_2\text{O})(\text{C}_2\text{H}_3\text{O}_2)](\text{PF}_6)$ (Cu-Bicyclen) was measured under varying conditions (incubation time, metal chelate concentration, and pUC19 DNA concentration). Fe-EDTA, known for its DNA cleavage activity, was used as a control to compare to Cu-Bicyclen. Preliminary data indicate that Cu-Bicyclen may cleave DNA but its activity is much weaker than that of Fe-EDTA. Future work will include designing a specific DNA binding domain (including the use of TAL effectors) aimed at the nuc gene of Staph. aureus (a gene that codes for an infectious protein agent).

05.05.18 The metal chelate Cobalt Bicyclen as a Potential DNA Cleavage agent for Artificial Nucleases

Lori,Gwyn *Southwestern Oklahoma State University*

Megan,Oertel *Southwestern Oklahoma State University*

Tim,Hubin *Southwestern Oklahoma State University*

Methicillin resistant Staphylococcus aureus, commonly known as MRSA, is a strain of bacteria that is resistant to most antibiotics. This can pose a problem in the medical community when the antibiotics used to treat often fatal bacterial infections no longer work. One idea to incapacitate this infection is to specifically target sequences of infectious genes such as SaeR in the MRSA genome. To do this, enzymes known as nucleases can be designed to specifically target the phosphodiester bonds of the genes in the bacteria's genome. Our approach in engineering an artificial nuclease is to first test the hydrolysis activity of different metal chelates. Previous research has shown that small molecule metal chelates such as Fe-EDTA catalyze this type of reaction. The metal chelate, $[\text{Co}(\text{C}_{12}\text{H}_{26}\text{N}_4)\text{Cl}_2](\text{PF}_6)$ (referred to as Co- Bicyclen), was tested as a potential nuclease candidate by incubating the Co-Bicyclen with the pUC19 plasmid at room temperature in a solution of 100 μM HEPES, 100 μM ascorbate, and varying concentrations of 3% hydrogen peroxide. Preliminary results indicate that Co-Bicyclen shows nuclease activity under these conditions. Further assays will be conducted by varying other conditions to determine a mechanism for the reaction. Future goals include designing DNA binding domains such as TAL effectors to build an enzyme with specific DNA binding affinity.

05.05.19 Proliferation Assay in Tension-Free and Tension-Maintaining Skin Equivalents

Cory,Anderson *University of Central Oklahoma*

Melville,Vaughan *University of Central Oklahoma*

Mona,Hilal *University of Central Oklahoma*

As cell proliferation is key to many biological processes, such as wound healing and cancer development, it is important to perform proliferation assay that allows the determination of the number of cells growing and dividing. Cell proliferation can be affected by different internal and environmental factors. The goal of this study was to determine the effect of mechanical tension on proliferation by performing proliferation assays for tension-free and tension-maintaining skin equivalents. The engineered tissue was prepared by developing a dermal equivalent of normal human fibroblasts and type I collagen mixture and then plating the combination with keratinocytes. While plastic rings were inserted in the experimental group to provide tension, the control group lacked such plastic rings. After the tissue was allowed to mature, they were processed for frozen sectioning. DNA synthesis was detected based on the incorporation of 5-ethynyl-2'-deoxyuridine (EdU) into cellular DNA during DNA replication and the reaction of EdU with a fluorescent azide that allows the proliferated nuclei to become fluorescent green when detected through fluorescence microscopy. Preliminary quantification of the data demonstrated that proliferation was present in the dermal compartments of both the tension-free and the tension-maintaining tissue, with the tension dermis exhibiting greater proliferation than the tension-free dermis.

05.05.20 Quenching of Cyanoaromatics Fluorescence and Aromatic Carbonyl Triplets by Model Sulfur Compounds

Hunter,Wurtz *Cameron University*

Paritosh,Das *Cameron University*

Sulfur-bearing moieties play significant roles in various processes of interest to biology, agriculture, industry, and environmental pollution. The multifarious functions of S are made possible by the numerous oxidation states in which the element can exist, including some that are capable of facile redox interconversions. We have investigated several model organosulfur compounds for their charge-transfer interactions as donors with photoexcited singlet states of three cyanoaromatics, namely, 1,2,4,5-tetracyanobenzene (TCB), 1,4-dicyanonaphthalene (DCN), and 9,10-dicyanoanthracene (DCA) and with triplet excited states of aromatic ketones (e.g., benzophenone). This paper will present and examine kinetic data on the quenching of steady-state fluorescence of cyanoaromatics by several thiols, sulfides and disulfides and on the quenching of ketone triplets by several thiols (studied by nanosecond laser flash photolysis). In addition, the data on the efficiency of hydrogen transfer from thiols to ketone triplets will be presented.

05.05.21 Analysis and Comparison of Bio diesel and Diesel Used as Fire Accelerants

Rumer, Rodne *University of Central Oklahoma*

Fires can occur unintentionally (accidental), occur naturally, or be intentionally started which is arson. No matter how the fire occurred, it can destroy a lot of property as well as cost humans their lives, which makes it hard to investigate how a fire was started. Often in the case of arson a fire accelerant is used to help spread the fire and collection of debris from the fire is important as traces of the fire accelerant could be detected in the debris. In this study biodiesel and diesel were used as fire accelerants to start fires and the debris from those fires was used to see if the fire accelerant could be determined using a carbon strip and Gas Chromatography- Mass Spectrometry (GC-MS). It was hypothesized there would be similarities between biodiesel and diesel as they have similar chemical properties however differences would be seen as they are two different fuels. The results from the GC-MS of both accelerants were analyzed and then compared against each other. The results showed that while biodiesel and diesel shared common characteristics which are typically seen in hydrocarbons in general, it was found that the two were different from each other. This information can be used in the criminal aspect as it can tell investigators what started the fire in an arson crime if an arsonist used biodiesel or diesel or eliminate the two as possible fire accelerants.

05.05.22 Progress Towards the Synthesis of 1 α -Hydroxyvitamin D5

Dragos, Albinescu *Northeastern State University*

This research project presents the progress towards the convergent synthesis of 1 α -hydroxyvitamin D5, a new, highly potent cancer chemopreventive agent, and also an effective inhibitor of renin gene expression. This vitamin D analog was able to reduce the tumor incidence up to 47% and tumor multiplicity up to 50% in chemically-induced mammary carcinogenesis experiments in rats. The convergent synthesis involves the copper (I) mediated coupling reaction of two independently synthesized fragments, namely, a vitamin D5 side chain, as a Grignard reagent, and a 1 α -hydroxylated core vitamin D structure (triene system), as a tosylate. The side chain was synthesized via an asymmetric alkylation of 3-butenic acid esterified with a chiral auxiliary (R-binaphthol) and the "triene" system was generated from vitamin D2, via a vitamin D2 sulfur dioxide adduct. This convergent synthesis is designed to offer a better synthetic alternative to the current linear synthetic pathway.

05.05.23 Subcloning and Characterization of *S. cerevisiae* aromatic aminotransferase

Andrew, Rutter *University of Oklahoma*

Christian, Fleming *University of Central Oklahoma*

lilian, Chooback *University of Central Oklahoma*

Russell, Evans *University of Central Oklahoma*

Sidra, Mesiya *University of Central Oklahoma*

William, Karsten *University of Oklahoma*

The α -aminoacidopate pathway for the biosynthesis of lysine in *Saccharomyces cerevisiae* is not present in humans; therefore, enzymes in the pathway are potential candidates for drug development for fungal infections. The fourth step in the pathway is catalyzed by an aminotransferase which converts α -ketoadipate to L- α -aminoacidopate. Based upon sequence homology 2 enzymes in *S. cerevisiae* is identified to be a good candidate for the aminotransferase in question, Aro8 and Aro9. The Aro8 gene has been cloned and characterized. Currently, we have cloned the gene for aromatic aminotransferase 9 (Aro9) into the expression vector PET16b. The protein expression, purification and characterization of the protein were performed. The protein is expressed poorly. Based upon this result, the gene for Aro9 is sequenced to verify the integrity of the gene and the presence of histidine tag. Based upon the result the clone will be modified to produce higher concentration of the protein. Kinetic studies of the pure enzyme will follow.

05.05.24 Organic Synthesis of Potential Inhibitors for Dihydrodipicolinate Synthase

Christian, Fleming *University of Central Oklahoma*

lilian, Chooback *University of Central Oklahoma*

Russell, Evans *University of Central Oklahoma*

William, Karsten *University of Oklahoma*

Dihydrodipicolinate synthase (DHDPS) catalyzes the formation of dihydrodipicolinate from pyruvate and aspartate- β -semialdehyde (ASA). This reaction is the first committed step in the lysine biosynthetic pathway in bacteria and some plants. The absence of such a pathway in humans has made DHDPS an interesting target for novel drugs. Inhibitors of DHDPS are believed to contain antibiotic properties. Based upon this, 2-hydroxy-4-oxobutanoic acid and 4-hydroxy-2-oxoheptanedioic acid have been designed and will be synthesized. Kinetic studies of the inhibitors will be performed to investigate the mode of inhibition.

05.05.25 FISCHER ESTERIFICATION BY MICROWAVE IRRADIATION USING VARIOUS ALCOHOLS (OR CHEMISTRY DOESN'T HAVE TO STINK)

Jessica,Cheng *Northeastern State University*

Spence,Pilcher *Northeastern State University*

In today's world of instant coffee, instant meals, and instant messaging, undergraduate students prefer not to have to wait long periods of time for an organic reaction to take place. Heating with microwaves is rapidly becoming more commonplace due to dramatically reduced reaction times and higher product yields. Many experiments that are commonly performed in the organic II laboratory course require heating times of one hour. One such reaction is the Fischer esterification where a carboxylic acid is heated with an alcohol in the presence of an acid catalyst producing an ester. In the past, the organic chemistry lab at NSU performed a Fischer esterification by heating benzoic acid with excess methanol producing methyl benzoate with an average yield of 53%. In this work, a procedure was developed using microwave irradiation as the heat source in which glacial acetic acid was heated with 15 different alcohols separately resulting in a variety of different products. Each product was obtained after a reaction time of only 5 minutes heating at 120°C. Yields for the products ranged from 32%-79%. The developed procedure will be introduced in the organic II laboratory curriculum at NSU for the first time during the Spring 2015 semester. Students will be assigned an alcohol at the start of the laboratory period, will perform the reaction, calculate the percent yield and compare to other reactions that were performed in class, and then try and identify the odor of

05.05.26 Opioids and Non-Steroidal Anti-Inflammatory Drugs in biological function Faculty Advisor : A.K.Fazlur Rahman

Allen,Chen *Oklahoma School of Science and Mathematics*

This presentation will discuss our understanding of pain killers and its biological action. Pain killers work through a variety of functions, including prostaglandin inhibition and the activation of opioid receptors in the nervous system. Non-Steroidal Anti-Inflammatory Drugs are the most common, mainly inhibiting the action of cyclooxygenase enzymes, which are involved in provoking pyretic and inflammatory responses from the body. Since they all have a similar function, their side effects also share similarities, mainly arising from the inhibition of cyclooxygenase. Opioids, which are drugs that interact with the nervous system and affect the brain's response to pain, are the other main category of painkillers. Since they actually interact with the brain, they can be extremely addictive and habit-forming, but also can sometimes be the only form of effective treatment available for a patient. The purpose of this paper is to investigate the link between the chemical structure of these molecules and their medical functions.

05.05.27 (Unnamed)

A.K.Fazlur,Rahman *Oklahoma School of Science and Mathematics*

Tina,Wu *Oklahoma School of Science and Mathematics*

This presentation describes the usage of precious metals in medicine. platinum complexes are known to treat cancer due to its ability to prevent the division of living cells. Silver complexes interrupt the ability of bacteria cells to form bonds which causes the bacteria to fall apart. Gold nanoparticles have recently been found to be effective, in the treatment of cancer. Further research with precious metal nanoparticles may lead to effective cure for cancer in the near future.

05.05.28 Structure Determination of the Siderophore: Rhodotorulic Acid

Mariah, Penland *Northeastern State University*

Iron limitation is a major factor influencing the growth of microorganisms, from infection of a mammalian host (where iron is tightly controlled by protein complexation) to aquatic and marine environments (where iron is not soluble or is complexed by organic ligands). Many microorganisms produce low-molecular-weight, iron(III)-specific chelators called siderophores to compete for iron. The objectives of this project are to identify novel siderophores produced by different marine-derived fungal strains and to evaluate them for use as antimicrobial or antineoplastic agents. Marine fungal strains were evaluated for siderophore production using an iron-dye containing agar. Siderophore-producing strains were cultured in artificial seawater broth, the iron-binding compounds were isolated by RP-HPLC, and the purified compounds were analyzed by mass spectrometry. The final structure determination was made by NMR (^1H , ^{13}C , ^1H - ^1H COSY, and HMBC). The siderophore produced by *Sporidiobolus salmonicolor* 05-001 was found to be rhodotorulic acid.

05.05.29 Investigating Room Temperature Ionic Liquid Recovery

Jody, Buckholtz *Northeastern State University*

John, Moore *Northeastern State University*

This project seeks to characterize the effect of chemical hydrolysis of cellulose on the solvent, 1-Methyl-3-Octylimidazolium Chloride, by proton NMR. Additionally, data for recovered dry mass of cellulose and fermentable sugar concentration in the hydrolysis solution were also collected. While discoloration of the solvent was seen, there were no changes in structure detected. A total of 3 hydrolysis reactions were carried out in series and then replicated several times. There was an average of 12% loss of cellulose per reaction.

05.05.30 Application of Silver, Gold, and Platinum complexes in Medicine : An Educational Study

Tina, Wu *Oklahoma School of Science and Mathematics*

This review summarizes the uses of silver, gold, and platinum complexes and nanoparticles in medicine. The use of metals in medicine was unknown or limited in the ancient world. In the field of medicine, metals are most commonly used in complexes or as nanoparticles. When used in complexes, the compounds attach to various ligands in the body to serve different functions. Most notably, platinum complexes were developed to treat cancer due to its ability to prevent the division of living cells. Similarly, silver complexes interrupt the ability of bacteria cells to form bonds which causes the bacteria to fall apart. Beginning in the 20th century, developments were made in the field of nanomedicine and the use of nanoparticles. While silver nanoparticles are relatively inert, gold nanoparticles were found to be very effective, especially in the treatment of cancer. With the knowledge of both complexes and nanoparticles, further research could lead to the discovery of effective cures for cancer.

05.05.31 Stem Education Enhancement in Oklahoma : Teaching Chemistry to 4th and 5th Grade Elementary Children by High School Students

A.K.Fazlur,Rahman *Oklahoma School of Science and Mathematics*

Angela,Zhao *Oklahoma School of Science and Mathematics*

Nathan,Wu *Oklahoma School of Science and Mathematics*

Tina,Wu *Oklahoma School of Science and Mathematics*

As part of our Chemistry education enhancement program at the Oklahoma School of Science and Mathematics to promote science education to elementary schools across the State of Oklahoma we have launched a " Science is Fun " program to teach science 4th, 5th and 6th grade students by the 11th, 12th grade gifted OSSM students . This program is funded for a year by Dreyfus Foundation. In all these demonstrations we have used power point presentations, visual teaching using molecular models and science experiments to entertain and teach the students basic scientific concepts. We have accomplished our goal given the treacherous weather during the last spring semester and later part of the fall semester. In class session was about 50-60 mins . In most cases classes were held in the school auditorium to accommodate 120-150 students. In all cases, in each school two students taught each session. Four elementary schools were visited this year and 14 student's teachers taught about 950 students.

05.05.32 Teaching Chemistry to 4th and 5th grade Elementary Students : STEM Educational Enhancement in Oklahoma

A.K.Fazlur,Rahman *Oklahoma School of Science and Mathematics*

Jane,Chin *Oklahoma School of Science and Mathematics*

Nathan,Yu *Oklahoma School of Science and Mathematics*

Sooraj,Boominathan *Oklahoma School of Science and Mathematics*

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05.05.33 Application of Silver, Gold, and Platinum complexes in Medicine

A.K.Fazlur,Rahman *Oklahoma School of Science and Mathematics*

Allen,Chen *Oklahoma School of Science and Mathematics*

This review summarizes the various usage of silver, gold, and platinum complexes and nanoparticles in medicine including some future perspective. The use of metals in medicine was rare in the ancient world. Recent research showed the versatility of metals in pharmacology and medicine. In medicine, metals are now used as complexes or as nanoparticles. When used as complexes, the compounds attach to various ligands in the body to serve targeted functions. Platinum complexes are used to treat cancer due to its ability to prevent the division of living cells. Silver complexes interrupt the ability of bacteria cells to form bonds which causes the bacteria to fall apart. While silver nanoparticles are relatively inert, gold nanoparticles were found to be effective, especially in the treatment of cancer.

05.05.35 Organic Compounds as Glaucoma and Antiulcer Agents :

A.K.Fazlur,Rahman *Oklahoma School of Science and Mathematics*

Brian,Dick *Oklahoma School of Science and Mathematics*

Glaucoma is an eye condition that damages the optic nerve. Although initially asymptomatic, glaucoma leads to blindness. Current treatment for glaucoma includes the use of organic compounds such as Timolol, Bimatoprost (lumigan), and travoprost (Travatan). For Ulcer treatment organic compounds such as Cimetidine(tagamet), Nizatidine(Axid) and Famotidine(Pepcid). During the presentation structural aspect of these compounds and biological function will be discussed.

05.05.36 Distribution and Quantity of Iodine in Northwestern Oklahoma Brine Waters

Austin,Anderson *Northwestern State University*

Cori,Hoffman *Northwestern State University*

David,Edlin *Iofina Resources, Inc*

Jason,Wickham *Northwestern State University*

In the late 1970's, it was discovered that the brine waters of northwestern Oklahoma contain significant amounts of Iodine (above 60 ppm). However, the exact amounts and distributions of Iodine throughout this brine water formation were unknown. Currently, the majority of the world's supply of Iodine comes from mining Iodate minerals in Chile (~65%), brine water aquifers in NW Oklahoma (~5%) and Japan (~25%), and seaweed extraction. With the growing need for Iodine compounds in the medical, agricultural, and technological fields the demand for Iodine is higher than ever. Thus, Iofina has recruited the aid of Northwestern Oklahoma State University to quantify the Iodine concentration and distribution throughout the brine aquifer, as well as, determine the longevity of these iodine concentrations. Currently, this has resulted in the discovery of new sites within the aquifer that contain concentrations above 300 ppm and show that the iodine levels are currently steady within about a 5 ppm fluctuation.

05.05.37 Changing the Way We Teach Undergraduate Organic Labs Using Microwave Synthesis.

Alexander,Rivas *Cameron University*

Elizabeth,Nalley *Cameron University*

Kristen,Worthen *Cameron University*

Taiwo,Adelusi *Cameron University*

Taj,Ahmad *Cameron University*

Allowing many chemical reactions to be completed within minutes, microwave heating has revolutionized preparative chemistry. As a result, this technology has been widely adopted in both academic and industrial laboratories. Integrating microwave-assisted chemistry into undergraduate laboratory courses enables students to perform a broader range of reactions in the allotted lab period. As a result, they can be introduced to chemistry that would otherwise have been inaccessible due to time constraints (for example, the need for an overnight reflux). A number of the chemical transformations use water as a solvent in lieu of classical organic solvents. This contributes to greener, more sustainable teaching strategies for faculty and students, while maintaining high reaction yields. The advantages inherent in microwave use make it ideal for the undergraduate laboratory. Although students are exposed to many different reactions in the classroom, many important organic reactions described in undergraduate textbooks are presently not included in the laboratory course owing to long reaction times, high temperatures, or sensitive reagents that present a potential danger to the students. In this poster, five syntheses using microwave heating will be described.

05.05.38 Organic Dyes Improving the Efficiency of Dye-Sensitized Solar Cells

Ciera,Kelley *Cameron University*

Elizabeth,Nalley *Cameron University*

Jessica,Gesell *Cameron University*

Kristen,Worthen *Cameron University*

Miwa,Fukuda *University of Oklahoma*

In this research dye-sensitized solar cells were constructed using an organic dyes with titanium dioxide nanocrystals. Different formulations of Titanium Dioxide with different sized particles were used and the properties and performance of the solar cells were compared. These cells consist of titanium dioxide nanocrystals that are coated with light-absorbing dye molecules and immersed in an electrolyte solution, which is sandwiched between two glass plate. Different dyes both commercially available and synthesized in our laboratory were tested to determine which dye produced the highest voltage were tested. Light striking the dye frees electrons and creates "holes"--the areas of positive charge that result when electrons are lost. The semiconducting titanium dioxide particles collect the electrons and transfer them to an external circuit, producing an electric current. The cells can be connected in series to produce cells with voltages as high as five volts which can be used to power a small motor.

05.05.39 Computational Studies of Transition Metal Hydroxides

Cerina,Stiles *East Central University*

Dwight,Myers *East Central University*

Laura,Asaro *East Central University*

Modern superalloys used in the construction of turbomachinery contain a wide variety of metals in trace quantities. Formation of volatile metal hydroxides at elevated temperatures is an important mechanism for corrosion of metal alloys or oxides in combustion environments (N. Jacobson, D. Myers, E. Opila, and E. Copland, J. Phys. Chem. Solids 66, 471-478, 2005). Theoretical calculations of reaction energies are an important check on experimental results. However, computational methods involving transition metals are more challenging than for lighter elements. The focus of this project is to examine the effects of different basis sets on energies for the hydroxides of scandium, cobalt, and manganese. Initial results will be presented.

05.05.40 (Unnamed)

Lindsay,Davis *Langston University*

The purpose of this project is to increase the efficiency of the Fischer-Tropsch process by targeting the most effective catalyst for the reaction. In previous work, different compositions of nanoparticle metal oxides (Co, Fe, and Cu) co-entrapped sol-gels were synthesized, reduced, and ran catalytic reaction. The products were analyzed using a gas chromatography system (GC). The samples were analyzed after synthesis, reduction, and catalytic reaction using a Vibrating Sample Magnetometer (VSM) for their magnetic properties and the Differential Thermal Analysis (DTA) and Thermal Gravimetric Analysis (TGA) for their thermal properties. Our goal was to analyze the samples after each process to determine a trend in our result that could possibly lead to a reasonable conclusion. The main objective of this project is to study the order of ferromagnetism for each of the samples. By analyzing the saturation magnetization of these samples, we will be able to provide estimations on metal loading, reduction efficiency, and poisoning of the catalyst.

05.05.41 Development of glucose amperometric biosensor based on self-assembling glucose oxidase on polydiallyldimethylammonium and multi-walled carbon nanotubes

Baljit,Sandhar *Northeastern State University*

Jude,Abia *Northeastern State University*

In this study, a glucose biosensor was developed using layer-by-layer self-assembly method in which glucose oxidase enzyme along with multi-walled carbon nanotubes were sandwiched by electrostatic attraction between two layers of polydiallyldimethylammonium chloride (PDPA) on a platinum electrode. Results show that the conductivity of the sensor was improved with the addition of the nanotubes. The functionality of the biosensor was tested in a three electrode system in a 0.1M phosphate buffer solution containing glucose. At an optimized applied voltage of 0.6V versus Ag/AgCl reference electrode, hydrogen peroxide generated from the enzymatic oxidation of glucose was detected and the resulting amperometric signal used to quantify glucose. The sensor showed a good linear range of 0.08 – 15mM, and a detection limit of 3.5 μ M. The biosensor also retained 90% of its initial activity of a few weeks of use.

05.05.42 Siderophore Production by Marine Fungi

Jessica, Martin *Northeastern State University*

Iron limitation is a major factor influencing the growth of microorganisms, from infection of a mammalian host (where iron is tightly controlled by protein complexation) to aquatic and marine environments (where iron is not soluble or is complexed by organic ligands). Many microorganisms produce low-molecular-weight, iron(III)-specific chelators called siderophores to compete for iron. The objectives of this project are to identify novel siderophores produced by marine fungi and to evaluate them for uses as antimicrobial or antineoplastic agents. Reported here are siderophores produced by marine fungi, antineoplastic activity of these compounds, and the effects of biological competition on siderophore production are being investigated.